

Fishery Data Series No. 99-39

Holitna River Angler Survey, 1998

by
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Alaska Department of Fish and Game

Division of Sport Fish



Symbols and Abbreviations

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Weights and measures (metric)		General		Mathematics, statistics, fisheries	
centimeter	cm	All commonly accepted abbreviations.	e.g., Mr., Mrs., a.m., p.m., etc.	alternate hypothesis	H _A
deciliter	dL	All commonly accepted professional titles.	e.g., Dr., Ph.D., R.N., etc.	base of natural logarithm	e
gram	g	and	&	catch per unit effort	CPUE
hectare	ha	at	@	coefficient of variation	CV
kilogram	kg	Compass directions:		common test statistics	F, t, χ^2 , etc.
kilometer	km	east	E	confidence interval	C.I.
liter	L	north	N	correlation coefficient	R (multiple)
meter	m	south	S	correlation coefficient	r (simple)
metric ton	mt	west	W	covariance	cov
milliliter	ml	Copyright	©	degree (angular or temperature)	°
millimeter	mm	Corporate suffixes:		degrees of freedom	df
Weights and measures (English)		Company	Co.	divided by	÷ or / (in equations)
cubic feet per second	ft ³ /s	Corporation	Corp.	equals	=
foot	ft	Incorporated	Inc.	expected value	E
gallon	gal	Limited	Ltd.	fork length	FL
inch	in	et alii (and other people)	et al.	greater than	>
mile	mi	et cetera (and so forth)	etc.	greater than or equal to	≥
ounce	oz	exempli gratia (for example)	e.g.,	harvest per unit effort	HPUE
pound	lb	id est (that is)	i.e.,	less than	<
quart	qt	latitude or longitude	lat. or long.	less than or equal to	≤
yard	yd	monetary symbols (U.S.)	\$, ¢	logarithm (natural)	ln
Spell out acre and ton.		months (tables and figures): first three letters	Jan., ..., Dec	logarithm (base 10)	log
Time and temperature		number (before a number)	# (e.g., #10)	logarithm (specify base)	log ₂ , etc.
day	d	pounds (after a number)	# (e.g., 10#)	mideye-to-fork	MEF
degrees Celsius	°C	registered trademark	®	minute (angular)	'
degrees Fahrenheit	°F	trademark	™	multiplied by	x
hour (spell out for 24-hour clock)	h	United States (adjective)	U.S.	not significant	NS
minute	min	United States of America (noun)	USA	null hypothesis	H ₀
second	s	U.S. state and District of Columbia abbreviations	use two-letter abbreviations (e.g., AK, DC)	percent	%
Spell out year, month, and week.				probability	P
Physics and chemistry				probability of a type I error (rejection of the null hypothesis when true)	α
all atomic symbols				probability of a type II error (acceptance of the null hypothesis when false)	β
alternating current	AC			second (angular)	"
ampere	A			standard deviation	SD
calorie	cal			standard error	SE
direct current	DC			standard length	SL
hertz	Hz			total length	TL
horsepower	hp			variance	Var
hydrogen ion activity	pH				
parts per million	ppm				
parts per thousand	ppt, ‰				
volts	V				
watts	W				

FISHERY DATA SERIES NO. 99-39

HOLITNA RIVER ANGLER SURVEY, 1998

by

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ABSTRACT

During the periods 25 June through 16 July and 22 through 28 August, 1998 an angler survey was conducted between mile 20 and mile 55 of the Holitna River. During the June and July period 51 interviews were conducted and most anglers were targeting chinook salmon *Oncorhynchus tshawytscha*. Weekly estimates of CPUE for chinook salmon averaged 0.45 fish per hour. Participation was highest during the first week of the survey with a maximum daily count of 13 anglers and 5 boats. Fishing for chinook salmon was concentrated near the mouth of the Hoholitna River.

In the August period 50 anglers were interviewed: the primary species targeted was coho salmon. Average CPUE for coho *O. kisutch* in August was 1.3 fish per hour. The maximum daily count during the August period was 13 anglers and five boats. The coho fishery was not concentrated like the fishery for chinook and was distributed throughout the survey area.

Most of the anglers interviewed were guided (72%) and were not residents of Alaska (91%). No local anglers were interviewed in the survey area. Most anglers remained in the survey area for approximately one week. In addition to salmon, a small proportion of anglers targeted northern pike *Esox lucius* (19%) and sheefish *Stenodus leucichthys* (5%).

Eighteen of 20 chinook salmon sampled were males with 65% age –1.3 and 30% age –1.4. Most coho salmon were age –2.1 (84%) and 73 of 114 sampled were males. Northern pike were generally not retained in the sport fishery. Northern pike sampled in test fishing efforts ranged in length up to 1,093 mm FL and in age to age-19. Few sheefish were obtained; 25 sheefish ranged in length between 525 and 805 mm FL and in age groups age-5 through age-8. Arctic grayling *Thymallus arcticus* and Dolly Varden *Salvelinus malma* were not targeted by anglers in the survey area.

Key words: angler survey, Holitna River, Kuskokwim River, catch per unit effort, chinook salmon, *Oncorhynchus tshawytscha*, coho salmon, *O. kisutch*.

INTRODUCTION

The Alaska Department of Fish and Game (ADF&G) conducted an angler survey on the Holitna River during 1998 with the goal of assessing the sport fisheries. The ADF&G uses the Statewide Harvest Survey (SWHS) to track levels of sport fishing effort, harvest, and catch for sport fisheries throughout Alaska. The SWHS provides a cost-effective method of monitoring general levels of participation in sport fisheries in remote locations. The SWHS is not able to provide in-season estimates for fisheries nor is it able to provide detailed information on the location, timing or nature of fisheries nor demographics of participants. The ADF&G uses angler surveys to estimate sport angler effort, catch and harvest when in-season estimates and more site-specific data are needed. Fiscal constraints dictate that surveys be conducted on larger fisheries within an area or on fisheries with pressing fishery management concerns. Periodically, the ADF&G undertakes studies of growing or rapidly changing sport fisheries to obtain basic fishery information and to assess the potential for management problems. This report provides the results of a study conducted to assess recent changes in the sport fisheries in the Holitna River.

The Holitna River drainage includes the Hoholitna River drainage and is a major tributary of the Kuskokwim River. The Holitna River joins the Kuskokwim River approximately 540 km (336 mi) upstream from the mouth of the Kuskokwim River near the village of Sleetmute (Figure 1).

Management responsibility for sport fisheries in the Kuskokwim drainage upstream of the Aniak River is assigned to Region III staff based in Fairbanks. Within this upstream portion of the watershed, the Holitna River is the most important tributary of the Kuskokwim River for sport

fishing. In 1997 the Holitna drainage supported approximately 63% (2,063 of 3,262) of the angler-days, 59% of the total sport harvest and 60% of the total sport catch which occurred in the Kuskokwim watershed upstream of the Aniak River (Table 1; Howe et al. 1998).

The importance of the Holitna River system to the area's sport fisheries is due to the diversity and abundance of the resident and anadromous species using the drainage. The Holitna River supports resident populations of Dolly Varden *Salvelinus malma*, Arctic grayling *Thymallus arcticus*, northern pike *Esox lucius*, burbot *Lota lota*, sheefish *Stenodus leucichthys*, and various whitefish *Coregonus sp.* Rainbow trout *Oncorhynchus mykiss* occur only rarely upstream of the Aniak River and have not been reported from the Holitna drainage. All five species of Pacific salmon *Oncorhynchus sp.* are found in the Holitna River. Sport fishing is conducted by persons visiting the area on guided and sometimes personal fishing trips, or as sidelights to hunting activity in the fall. Historically, use of the Holitna River by anglers has been light. Sport fisheries that target chinook salmon, coho salmon, sheefish and northern pike in the Holitna River have been identified. Information on sport fishing effort, catch and harvest from this area has been limited to estimates from the SWHS. While sport harvest of all species in the Holitna River are modest, results from the SWHS indicate recent growth in the Holitna River fishery.

In 1995 sport fishing effort was estimated to be 640 angler-days, similar to average estimates since 1987 (Table 1). Variability in angler-day estimates is due in part to low response rates. However, during 1997 estimated effort increased to 2,063 angler-days, the highest estimates on record. The estimate for 1997 is roughly twice the recent 11-year and 5-year averages.

Estimates of harvest and catch for resident and anadromous species indicate increases in the level of use of these species in the Holitna River. However the level of use remains modest. While the estimated level of harvest from 1996 and 1997 of many species is approximately double compared to longer term averages, the harvest of all species combined is about 1,000 fish or less. The level of catch-and-release fishing for three resident species, northern pike, sheefish and Dolly Varden, appears to have increased markedly as indicated by estimates of catch (Table 1).

In 1997 local residents reported that angling effort, by guided anglers living outside of the area, increased dramatically in the last few seasons, particularly in 1997. While the 1997 estimates were not available at that time, there is evidence as summarized above that growth in the fisheries occurred (Table 1). Local information indicated that a few high-volume guide/outfitters established permanent lodges and camps within the area and were bringing in large groups (20 or more) of clients.

Concern over the perceived growth in the Holitna River sport fisheries prompted residents of Sleetmute to submit five proposals to the Alaska Board of Fisheries (BOF) during the 1997 meeting cycle. Two of these proposals requested restrictions in the size and kind of aircraft and boats that could be used to access the Holitna River area. The BOF did not adopt these proposals. The three remaining proposals requested reductions in bag and possession limits for king (chinook) salmon, sheefish, and northern pike. Prior to 1998, the bag limits for these species were the same as the background regulations for the area: chinook- 3 per day, only 2 over 28 inches; sheefish – 10 per day; northern pike – 10 per day. The BOF elected to reduce limits for these and other species in the Holitna drainage and in the remainder of the Kuskokwim

Table 1.-Estimated sport fishing effort, harvest and catch of principal species in the Holitna River drainage (1987-1997).^a

	Year											Averages	
	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1987-97	1993-97
Holitna River													
Fishing Effort (days fished)	833	346	722	398	1,022	480	763	949	640	1,045	2,063	842	1,092
Harvests													
Chinook salmon	42	18	156	0	0	23	68	40	19	235	173	70	107
Chum salmon	42	0	0	14	119	91	208	0	0	28	0	46	47
Sockeye salmon	21	0	0	0	0		43	0	0	12	25	9	16
Coho salmon	145	91	0	12	205	130	0	0	170	159	423	121	150
Arctic grayling	543	73	128	18	312	23	0	0	184	121	143	140	90
Northern pike	97	528	82	53	504	145	9	155	166	79	-214	185	125
Sheefish	217	36	90	53	128	173	45	130	113	0	183	106	94
Arctic char	147	36	50	18	216	0	79	0	52	51	72	66	51
Total Harvest	1,254	782	506	168	1,484	562	452	325	704	685	1,233	695	680
Catch													
												Averages	
												1990-97	1993-97
Chinook salmon	0	0	0	27	0	109	375	110	91	804	814	291	439
Chum salmon	0	0	0	101	159	471	881	38	327	193	103	284	308
Sockeye salmon	0	0	0	0	76	0	902	0	0	120	75	147	219
Coho salmon	0	0	0	122	205	154	0	0	472	973	1,277	400	544
Arctic grayling	0	0	0	264	1,953	8	372	228	631	2,352	2,552	1,045	1,227
Northern pike	0	0	0	317	830	752	842	973	1,488	1,125	2,092	1,052	1,304
Sheefish	0	0	0	158	372	508	1,317	189	472	206	1,539	595	745
Arctic char	0	0	0	35	3,038	164	1,326	9	430	304	1,093	800	632
Total Catch	0	0	0	1,024	6,633	2,166	6,015	1,547	3,911	6,077	9,545	4,615	5,419
All Kuskokwim Drainages upstream from Aniak River (all species)													
												Averages	
												1987-97	1993-97
Fishing Effort (days fished)	0	1,258	1,539	1,767	944	2,062	1,929	1,754	1,803	1,864	3,262	1,653	2,122
Total Harvest		4,549	2,420	1,203	3,623	1,536	1,095	1,655	1,271	1,309	2,086	2,159	1,483

^a Unpublished data from the SWHS.

drainage downstream from the Holitna. The new regulations for the Holitna River are listed in Table 2.

Table 2. -Sport fishing regulations for the Holitna River drainage, 1998.

Species	Bag	Size Limit	Season
Chinook salmon	3	(only 2 over 28")	May 1 through July 25.
Other salmon	5	no size limit	entire year
Arctic char/ (all lakes)	2	no size limit	entire year
Dolly Varden (flowing water)	3	no size limit	entire year
Lake trout	4	no size limit	entire year
Rainbow trout	2	(only 1 over 20")	entire year
Arctic grayling	2	no size limit	entire year
Sheefish	2	no size limit	entire year
Northern pike	5	(only 1 over 30 inches)	entire year
Burbot	15		entire year
Other fish	no limit		entire year

The overall goal of the current Holitna River project was to ascertain the levels of guided and unguided angling activity and to initiate biological studies of the fish stocks of the Holitna drainage. These data were needed for evaluation of potential changes in these stocks and in evaluation of recent and future changes in the character of the sport fisheries.

OBJECTIVES

The objectives for the 1998 angler survey applied to sport fishing which occurred in the lower 50 mi (80 km) of the Holitna River for sheefish, northern pike, chinook salmon and other resident species in June and July, and for coho salmon and other resident species in August. Test fishing to estimate sex ratio of Pacific salmon was to have occurred at a site within the lower river.

The angler survey objectives were to:

1. estimate the weekly catch per unit effort (CPUE) in each survey area, such that weekly estimates of CPUE for chinook salmon during the 24 June-20 July period are within ± 0.3 fish per hour of the true values 90% of the time, and the estimates of CPUE for coho salmon during the 17-28 August period is within ± 0.4 fish per hour 90% of the time;
2. index daily angler effort during each sample day; and,
3. estimate the age, sex, and length compositions of sheefish, northern pike, chinook and coho salmon harvested by the sport fisheries such that estimates are within 10 percentage points, 95% of the time.

The test fishing objectives were to:

4. test the hypothesis that the sex ratio of Pacific salmon captured by beach seine in the lower Holitna River is equal to the sex ratio of Pacific salmon examined at the Kogruklu River weir, such that the test will detect a 0.15 difference in the proportion of females at $\alpha = 0.05$ and $\beta = 0.20$; and,
5. estimate length and age composition of resident and anadromous species captured in test fishing gear during sample periods in June, July and August such that estimates are within 10 percentage points, 95% of the time.

In addition to the objectives listed above, the following tasks were identified and attempted:

1. summarize the proportion of angler-trips by terminal tackle type (flies, bait, or lures) and angler type (resident or nonresident; guided, unguided, or guides; and local or non-local);
2. summarize the proportion of angler-trips by species targeted by angler type during sampling periods in June, July and August;
3. summarize the proportion of angler-trips by fishing trip duration, and by group size;
4. describe the geographical location of sport fishing effort;
5. summarize test fishing results for presence/absence of resident fish species and for CPUE by each gear type during sample periods in June, July, and August; and,
6. collect otoliths from sheefish, and Dolly Varden for strontium analysis to determine anadromy in these species.

Due to field constraints, the area of the survey was reduced to the river section between river miles 23 and 55. Also, the dates of the survey were slightly altered, and occurred during 25 June through 16 July, and 22-28 August.

Success with test fishing objectives 4 and 5 was contingent on the existence of sampling sites suitable for collecting sufficient numbers of salmon to test the hypothesis concerning sex ratio and sufficient numbers of resident species to estimate length and age composition. Lack of suitable seining sites and extremely high water conditions precluded effective sampling and these objectives were therefore not met. However, summaries of test fishing results as outlined in Task 5 were completed.

METHODS

STUDY DESIGN

The angler survey was designed to characterize the sport fisheries that occur in the lower Holitna River in summer by estimating the weekly catch per unit effort, indexing the daily angler effort, and estimating the composition of the sport harvest. The survey also provided information on the terminal gear types used by anglers and the proportion of resident and non-resident and guided and non-guided anglers. The biological sampling portion of the study characterized anadromous and resident fish harvested in the sport fishery or captured during test fishing efforts. The proportion of fish of all species in length, age, or sex categories were estimated from samples collected.

Otoliths from sheefish were reserved for micro-chemical analysis of strontium distribution (Babaluk and Riest 1996 and Babaluk et al. 1997) in the otoliths to determine life history patterns.

SAMPLING PROCEDURES

A systematic roving creel survey was conducted to sample the sport fisheries (i.e., count anglers, conduct angler interviews, and sample the sport harvest for biological data). Angler interviews provided estimates of catch rates and information concerning angler-type and terminal gear used. A single angler count made each day at a fixed time was used to index fishing effort.

The survey area and time of season was selected to increase the likelihood that the survey would be conducted during the peak of the season for the sheefish and chinook or coho salmon sport fisheries and during the peak time of day. Information from local people and run timing information from the Kogrukluk River weir were used to narrow the timing and locations of the sport fisheries for salmon and resident species.

The survey was conducted between the mouth of the Titnuk River (mile 55) and the “sheefish hole” (mile 23, Figure 1). The sampling periods were 25 June through 16 July (chinook salmon and sheefish) and 22 - 28 August (coho salmon). There were five sampling days in each week; sampling days were Thursday through Monday. Each sampling day was from 1200 hours to 2030 hours. During each day, personnel conducted angler interviews, one angler count, and collected biological data from sport harvested fish. Both completed-trip and incompleting-trip angler interviews were conducted by personnel roving through the fisheries.

Length, age and sex composition of all fish species sampled from the sport fisheries were estimated as multinomial proportions. Estimates of length composition are in terms of the proportion of fish sampled in 25 mm categories. Age and sex distributions are in terms of the proportion of fish in age and sex groups.

The proportion of fish sampled during test fishing efforts in length and age groups was calculated from samples collected with a mix of fishing gear types. Samples were collected from the lower 100 mi of the Holitna drainage (including the Hoholitna River). Samples were collected with small mesh (2” stretch measure) gill nets, baited and unbaited hoop nets, beach seine, and hook and line gear. Careful records of fishing effort (set time) and catch of all species in each set with each gear type were maintained to facilitate calculation of catch per unit of effort (CPUE). Careful records of sampling location were maintained to document presence of and timing of use by resident species. To enhance capture probabilities for all fish (sizes and species) sampling was conducted in as many locations as practical and with the combination of gear types described.

DATA COLLECTION

Angler Interviews

During each day, survey personnel traveled throughout the fisheries to conduct interviews and a count of all anglers participating in the fisheries. Interviews were conducted during the time not used for angler counts. Interviews consisted of obtaining catch, harvest, angler type (guided, unguided, guides; resident, non-resident), terminal tackle, and general demographic information from anglers encountered in the fisheries.

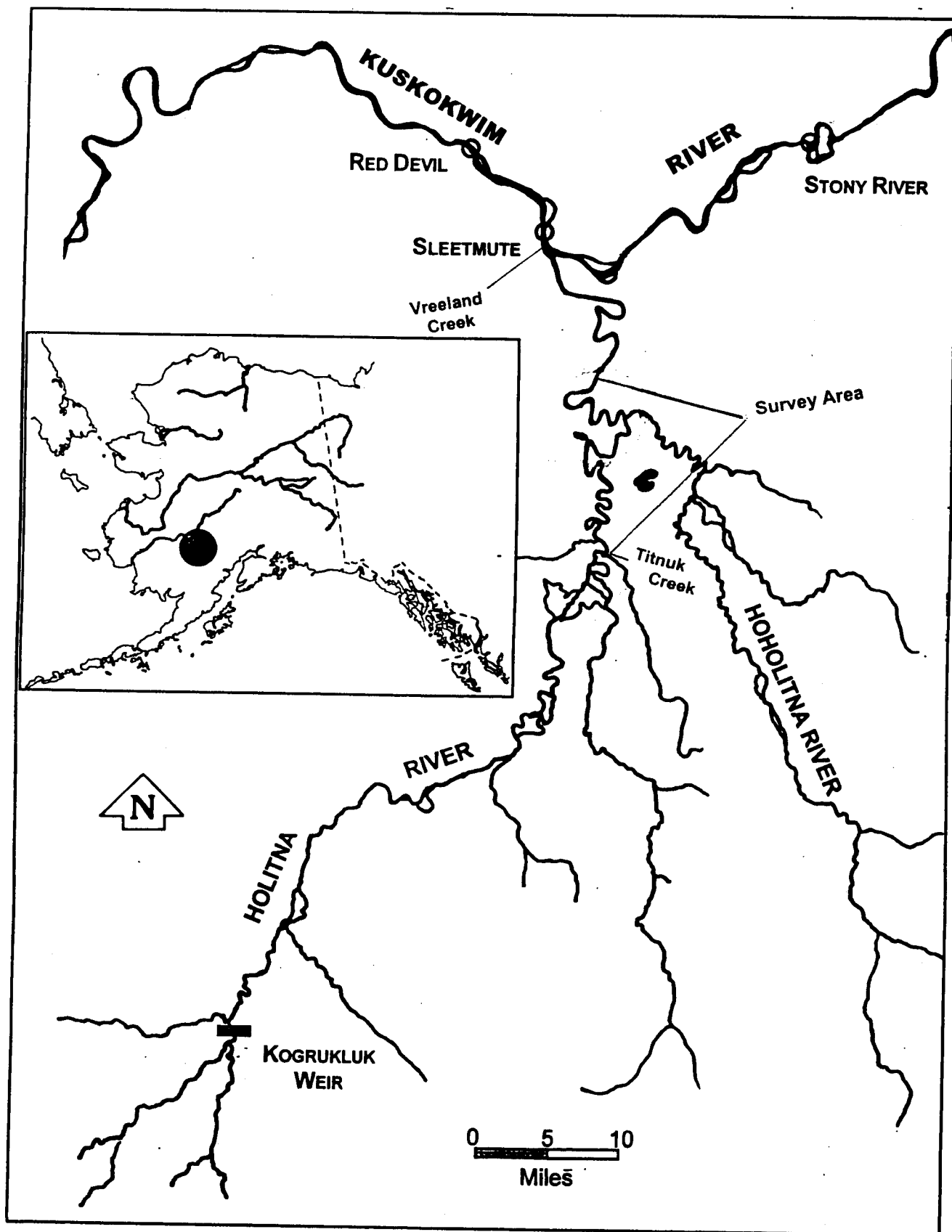


Figure 1.-Holitna River study area.

Both completed-trip angler interviews (anglers who have finished fishing for the day) and incompleting-trip interviews were collected. Survey personnel attempted to distribute their interview effort uniformly among all angling groups and geographically through the survey area. Interviews were, to the extent possible, conducted uniformly over time during each sampling day such that some completed-trip interviews were obtained each day. Every effort was made to interview a uniform and large proportion (over 70%) of the anglers present on a given sampling day.

Angler Counts

A single daily angler count was used to index fishing effort in units of angler-days. Angler counts took no more than 90 min to conduct. The creel technician traveled in a boat at a constant rate of speed through the fisheries from one end of the study area to the other and counted all active anglers. Active anglers was defined to mean people who were handling or using fishing rods and tackle; including people who may have interrupted their fishing to reposition their boat, land a fish, repair their gear (tie on a new lure, fix a tangle, etc.) or assist another person with their fishing activities. An active angler did not include a boat operator who did not operate fishing gear, or include a person who had put away their gear to eat lunch or to engage in some other activity not associated with angling.

CPUE As An Index Of Abundance

The survey design and the corresponding schedule was directed at obtaining a consistent proportional sample of the fishery throughout the progression of the sampled season. Accordingly, "weekly" estimates of CPUE should be unbiased as indices of abundance of the salmon as they pass through each fishery (Bernard et al. 1998).¹ Since all days of the week and all hours of the angling day were not sampled with equal probability (see above), then these estimates of CPUE are not expected to be unbiased estimates of the catch rate of the fishery as a whole. However, since the hours of the day and the days of the week to be sampled were consistent throughout the survey it is expected that the estimates of CPUE are reflective of gross overall changes in fish abundance (with the usual proviso that catchability remains constant).²

Since interviews were obtained by roving, "length of stay" (LOS) bias could be substantial in that the probability of interviewing anglers is proportional to the length of their daily fishing trip. This would be especially true if anglers tend to quit fishing upon filling their daily bag limit. In this case the LOS bias due to obtaining interviews by roving would be expected to result in underestimates of CPUE. However, since exit locations and methods of access for the fisheries are extensive (including float-planes), interviewing anglers at access locations at the end of their fishing trip(s) was considered unfeasible. Similarly, since the entire fishing day was not covered, anglers who exited the area prior to each sampling day could not be interviewed. If successful anglers tended to leave early in the fishing day, possibly before the sampling day begins, and the success varies such that on days with high catch rates the probability of interviewing successful anglers decreases then the estimates of CPUE would not accurately reflect the changes in catch rates.

¹ With the proviso that catchability of the fish remains constant throughout the course of the fishery.

² Estimates of CPUE as an index of abundance may be calculated separately for anglers who use guides versus anglers who do not use guides. These two types of anglers typically exhibit substantial differences in catch rates. If the make-up of the fishery in terms of guided versus unguided anglers changes through the course of the survey, then estimates of CPUE that ignore this distinction will not accurately reflect changes of fish abundance.

The general nature of the fisheries that were surveyed ameliorated the likelihood of severe LOS bias and its affects. Most anglers tended to participate throughout the angling day (e.g., they do not tend to leave the fishery after filling their bag limits early in the day). This was mostly due to the remote nature of the fisheries. Additionally, the comparatively non-restrictive daily bag limits (e.g., 3 per day, only 2 over 28 inches for chinook salmon) further reduced the likelihood of severe LOS biases.

Angler Effort Index

One angler count was conducted each sampling day at the same time. Accordingly, the count could not be used to estimate angler effort since all possible count times were not surveyed. If the distribution of angler effort throughout the sampling day does not vary during the course of the survey, then the counts obtained by this design would represent an unbiased index of the angler effort during the days sampled (i.e., larger counts = more angler effort). Conversely, if the within-day distribution of angler effort varies during the course of the survey (for example if anglers shift from morning to evening fishing), then the angler count would not be an unbiased index of the angler effort.

Angler Composition

Since all angling days were not covered in the schedule, data collected in regards to the composition of angler-trips (by terminal gear use and angler-type) associated with Tasks 1-4 is expected to be reflective of the makeup of the fisheries only on the days sampled. The same constraint on Tasks 1-4 information relates to the make-up in terms of the angling day (since only a portion of the angling day is covered during each sampled day). So if different types of anglers fish during the days of the week not sampled and/or during the hours of the day not covered then estimates of angler-trips by angler-type will not be representative of the whole fishery.

Biological Sampling

Sport harvested fish of all species encountered during the angler interview portion of the creel surveys were sampled. Each fish was measured to the nearest millimeter of fork length (mid-eye to fork-of-tail length for Pacific salmon), and sexed based on examination of gonads. Structures for age determination were collected from each fish sampled. Scales were collected from Pacific salmon, sheefish, and northern pike. Sagittal otoliths were collected from Dolly Varden, and sheefish.

Fish captured during test fishing were sampled in a similar manner as fish from the sport fisheries except that measurements and scales were taken from live fish. No fish were intentionally sacrificed during test fishing to obtain age or sex information. Incidental mortalities were processed like fish sampled from the sport harvest.

Standard age determination procedures were used (see Jearld 1983 for a general description of the principles used). For salmon, the numeral preceding the decimal is the number of freshwater annuli, whereas the numeral following the decimal is the number of marine annuli (European method). Total age from brood year is the sum of the two numerals plus one.

DATA ANALYSIS

Catch Rate

Weekly estimates of CPUE were calculated for each fishery according to the procedures outlined below. All of the individual angler interview data collected during the 5 days sampled in a week

were combined to obtain these estimates. The first step involves calculating the CPUE for each angler interviewed:

$$cpue_{hi} = \frac{c_{hi}}{e_{hi}} \quad (1)$$

where, c_{hi} equals the number of fish caught (both kept and released) by the i^{th} angler interviewed during the h^{th} week of the survey.

Then the weekly mean estimate of CPUE is simply:

$$\overline{cpue}_h = \frac{\sum_{i=1}^{m_h} cpue_{hi}}{m_h} \quad (2)$$

where, m_h equals the number of anglers interviewed within each week of the survey.

Estimates of CPUE as an index of abundance may be calculated separately for anglers who use guides versus anglers who do not use guides. These two types of anglers typically exhibit substantial differences in catch rates. If the make-up of the fisheries in terms of guided versus unguided anglers changes through the course of the survey, then estimates of CPUE that ignore this distinction will not accurately reflect changes of fish abundance.

Estimates of the variance of the mean CPUE estimates were calculated as follows:

$$\hat{V}[\overline{cpue}_h] = \frac{\sum_{i=1}^{m_h} (cpue_{hi} - \overline{cpue}_h)^2}{m_h(m_h - 1)} \quad (3)$$

Confidence intervals (to be used to compare CPUE from one week to the next) were estimated using the percentile bootstrap method (Efron and Tibshirani 1993).

Angler Effort

As noted above, the single angler count conducted each day represents an index of angler effort. The raw counts were used for this index.

Angler Composition

The proportion of angler-trips as defined by the categories of terminal gear type use and/or angler-type (e.g., guided versus unguided) were calculated as:

$$p_z = \frac{m_z}{m} \quad (4)$$

where m_z equals the number of the interviewed anglers whose trips are classified as category "z"; and m equals the total number of anglers interviewed that can be classified.

No estimates of the sampling variance were calculated, since these proportions are merely descriptive in nature (i.e., can not be inferred to be representative of the entire fishery).

Assumptions

The assumptions necessary for unbiased point and variance estimates for the various parameters obtained by the procedures outlined above include the following:

1. interviewed anglers accurately report their fishing time and the number of fish by species kept and released;
2. the survey technician accurately classifies anglers and the interviewed anglers accurately report their residency, trip type (guided, unguided, versus guides), and the terminal gear type used during their fishing trip;
3. catch rate and duration of fishing trip are independent (necessitated by the use of a roving method of interviewing - anglers with longer fishing trips have a greater probability of being intercepted for interview);
4. the distribution of angler effort within the angling day does not vary substantially during the course of the survey (necessary for CPUE to be an unbiased index of fish abundance, and for the single angler count to be an unbiased index of angler effort); and
5. catchability of the salmon does not vary substantially during the course of the survey (necessary for CPUE to be an unbiased index of fish abundance).

There are no direct ways of evaluating or testing the first assumption. Anglers are expected to have fairly good recollection of the total number of fish caught. Similarly, anglers are expected to accurately report their fishing trip characteristics (assumption 2).

The validity of assumptions 3 through 5, was addressed previously (see subsection: CPUE As An Index Of Abundance in the section: Study Design, above).

Biological Sampling

The proportion of fish of each species sampled from the sport harvest or from test fishing that are age u was estimated as:

$$\hat{p}_u = \frac{n_u}{n} \quad (5)$$

where n_u equals the number of the fish of each species sampled that are age u ; and n equals the total number fish of each species sampled within the survey.

For samples collected in the survey, $\hat{V}[\hat{p}_u]$ was calculated without correction for finite populations, since harvest estimates for 1998 were not yet available:

$$\hat{V}[\hat{p}_u] \approx \frac{\hat{p}_u (1 - \hat{p}_u)}{n - 1} \quad (6)$$

Length composition of the samples of fish of each species were estimated like age composition except that 25 mm length categories were used instead of age group.

Mean length-at-age of fish of each species harvested were estimated, following standard procedures (Sokal and Rohlf 1981).

RESULTS

Angler interviews and counts were completed daily between 25 June and 16 July and between 22 and 28 August. During the first sampling period (June – July) a total of 51 interviews were completed; 50 interviews were completed during the August sampling period.

Chinook Salmon Season: 25 June – 16 July.

Overall, on average, anglers spent an average of 2.2 h to catch a chinook salmon. The estimated average CPUE for anglers targeting chinook salmon was 0.23 (fish /hour) during the first week, 1.18 fish/hour during the second week and 0.00 fish/hour during the final week of the survey (Table 3).

The maximum number of anglers and boats counted in the study area during the daily index counts was 13 anglers and 5 boats (Table 4). These counts indicated that participation was highest during the first week of the survey (25-29 June). Counts of anglers and boats declined from 26 anglers and 10 boats during the first week to 14 and 7 the second week and 8 anglers and 4 boats the final week.

Coho Salmon Season: 22 – 28 August.

The coho fishery was sampled for a single 7-day period. The average CPUE for the period was 1.31 coho salmon per hour (Table 3); on average, anglers fished about 45 min to catch a coho salmon.

The maximum number of anglers and boats counted in the study area during the daily index counts was 9 anglers and 3 boats (Table 4).

In an attempt to determine if the mid-day sampling period that was selected for the angler survey (1200 to 1900 h) was appropriate, additional angler counts were conducted before and after the scheduled counting period. The extra counts were consistently less than the counts conducted during the scheduled period (Table 5).

Angler Characteristics

Interviews of anglers provided the following information on the sport fisheries and the participants.

Terminal Tackle

During the chinook salmon fishery, all anglers interviewed were fishing with artificial lures only (Table 6). In August, bait and flies were used by a small percentage of anglers in addition to other artificial lures.

Trip Duration

During all sample periods most anglers remained in the area for approximately one week (Table 7). However during July, about a third of the anglers interviewed visited the Holitna River for a single day.

Table 3.-Weekly estimates of catch (both harvested and released) of chinook and coho salmon from anglers interviewed on the Holitna River, 1998.

Week	n	Average CPUE	SE CPUE	Confidence Interval (90%)
<u>Chinook Season</u>				
25-Jun-98	34	0.23	0.05	[0.16 – 0.31]
2-Jul-98	13	1.18	0.49	[0.45 - 2.01]
9-Jul-98	4	0	0	[0.0]
Total	51			
<u>Coho Season</u>				
22-Aug-98	50	1.31	1.45	[0.96 - 1.64]
Total	50			

Table 4.-Number of anglers and boats counted during single daily counts between 1200 and 1330.

Date	Anglers			Boats		
	Guided	Unguided	Total	Guided	Unguided	Total
Chinook Fishery						
25-Jun-98	9	0	9	3	0	3
26-Jun-98	4	0	4	2	0	2
27-Jun-98	13	0	13	5	0	5
28-Jun-98	0	0	0	0	0	0
2-Jul-98	0	0	0	0	0	0
3-Jul-98	0	0	0	0	0	0
4-Jul-98	2	2	4	1	2	3
5-Jul-98	2	6	8	1	2	3
6-Jul-98	2	0	2	1	0	1
9-Jul-98	2	0	2	1	0	1
10-Jul-98	4	0	4	2	0	2
11-Jul-98	0	0	0	0	0	0
12-Jul-98	0	0	0	0	0	0
13-Jul-98	0	0	0	0	0	0
16-Jul-98	2	0	2	1	0	1
Total	40	8	48	17	4	21
Coho Fishery						
22-Aug-98	4	0	4	1	0	1
23-Aug-98	2	0	2	1	0	1
24-Aug-98	4	0	4	2	0	2
25-Aug-98	2	7	9	1	2	3
26-Aug-98	2	6	8	1	2	3
27-Aug-98	0	0	0	0	0	0
Total	14	13	27	6	4	10

Table 5.-Number of boats and anglers counted during additional counts conducted before and after scheduled counting period.

Date	Number of Boats			Number of Anglers		
	Early	Scheduled	Late	Early	Scheduled	Late
11-Jul-98		0	0		0	0
12-Jul-98		0	0		0	0
13-Jul-98	0	0	0	0	0	0
16-Jul-98	0	1	0	0	2	0
Total	0	1	0	0	2	0
22-Aug-98	0	1	0	0	4	0
23-Aug-98	0	1	0	0	2	0
24-Aug-98		2			4	
25-Aug-98	1	3	1	2	9	4
26-Aug-98	0	3	0	0	8	0
27-Aug-98	0	0	0	0	0	0
Total	1	10	1	2	27	4
TOTAL	1	11	1	2	29	4

Early - start at 0930 hr

Scheduled - start at 1200 hr

Late - start at 1830 to 2000 hr

Table 6.-Terminal tackle used by anglers interviewed during 1998 at the Holitna River.^a

		Lures	Bait	Flies	Total ^a
Chinook Fishery					
June	No. of anglers	37	0	0	37
	Percent	100	0	0	
July	No. of anglers	14	0	0	14
	Percent	100	0	0	
All Chinook					
	No. of anglers	51	0	0	51
	Percent	100	0	0	
Coho Fishery					
August	No. of anglers	50	4	5	50
	Percent	100	8	10	
All Sample Periods					
1998	No. of anglers	101	4	5	101
	Percent	100	4	5	

^a Total may be less than sum of row because some anglers used more than one terminal tackle type.

Table 7.-Duration of trip for anglers interviewed during 1998, Holitna River.

Length of Stay (days)	June		July		August		All 1998	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent
1	0	0	6	35	0	0	6	6
2	0	0	3	18	0	0	3	3
3	0	0	0	0	0	0	0	0
4	0	0	0	0	5	10	5	5
5	2	6	0	0	14	27	16	16
6	26	84	2	12	25	49	53	54
7	3	10	6	35	7	14	16	16
8	0	0	0	0	0	0	0	0
Total	31		17		51		99	

Group Size

The number of anglers in each group varied from two to seven (Table 8). The most common group size was two or three anglers.

Guided/ Non -Guided, Residency

During all sample periods, most anglers interviewed were guided (72%, Table 9). Non-resident anglers fishing without guides comprised 19% of all anglers interviewed. Only nine of 100 interviewed anglers were Alaskan residents and all of these anglers were fishing without guides. None of the resident anglers were local residents (residents of Sleetmute, Red Devil, Stony River, Table 10).

During the chinook salmon season 82% of the anglers interviewed were non- residents and were guided (Tables 9 and 10). All non-resident anglers during this period were guided. Resident, non-guided anglers made up the remaining 18% of anglers observed during the chinook season.

In August during the coho season, no resident anglers were encountered within the survey area (Tables 9 and 10). Sixty-one percent of non-resident anglers were guided.

Species Targeted

During 1998, most anglers who identified a target species, fished for chinook (37%), coho (39%) or northern pike (19%, Table 11). Differences in species targeted were observed between residents and non-residents. All anglers that said they were targeting sheefish were Alaskan residents. In addition, the proportion of Alaskan residents targeting coho salmon was much less than reported by non-residents. However, the number of residents interviewed during 1998 was very small.

During the late June- mid July sample period, most (36 of 40, 90%) anglers targeted chinook salmon. Small proportions of anglers said they were targeting either northern pike (2, 5%) or sheefish (4, 10%).

In the August period, most anglers targeted coho salmon but in contrast to anglers from the earlier season, a larger proportion targeted northern pike.

Geographical Distribution of Sport Fishing

The study area extended from mile 23 through mile 55 (the mouth of Titnuk Creek). In June all fishing occurred near the mouth of the Hoholitna River (mile 33; Table 12). In July, anglers were more dispersed. Anglers targeting sheefish were found near mile 23 while some chinook anglers fished the mouth of Titnuk Creek at mile 55. In August anglers were generally not concentrated; many good sites for coho salmon and northern pike are found throughout the study area.

Length, Age and Sex Sampling

Fish harvested by anglers and fish caught when survey personnel were present were sampled during the interview process. The number of fish sampled from the sport fisheries was quite low. The numbers of fish of various species sampled were: chinook salmon, 19; coho salmon, 19; northern pike, 4; and sheefish, 8 (Table 13).

The catch and harvest of these fish species reported by anglers during interviews is listed in Table 13. A high proportion of the reported harvest was sampled.

Table 8.-Percent of anglers encountered in groups of various sizes during interviews.

Group Size	June		July		August		All 1998	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent
1	0	0	0	0	0	0	0	0
2	3	33	1	25	3	25	7	28
3	4	44	1	25	3	25	8	32
4	0	0	0	0	2	17	2	8
5	2	22	0	0	1	8	3	12
6	0	0	2	50	0	0	2	8
7	0	0	0	0	3	25	3	12
8	0	0	0	0	0	0	0	0
Total	9		4		12		25	

Table 9.-Guided and unguided anglers interviewed during 1998 at the Holitna River.

		Guided			Un-Guided			
Date		Resident	Non-Resident	All	Resident	Non-Resident	All	Total
Chinook Fishery								
June	Number	0	34	34	0	0	0	34
	Percent	0	100	100	0	0	0	
July	Number	0	8	8	9	0	9	17
	Percent	0	100	47	100	0	53	
All Chinook	Number	0	42	42	9	0	9	51
	Percent	0	100	82	100	0	18	
Coho Fishery								
August	Number	0	30	30	0	19	19	49
	Percent	0	0	61	0	100	39	
All Sample Periods								
1998	Number	0	72	72	9	19	28	100
	Percent	0	100	72	32	68	28	

Table 10.-Residency of anglers interviewed during 1998 at the Holitna River.

		Resident			Non-Resident			Total
		Local	Non-Local	All	USA	Foreign	All	
Date								
Chinook Fishery								
June	Number	0	0	0	30	4	34	34
	Percent	0	0	0	88	12	100	
July	Number	0	9	9	8	0	8	17
	Percent	0	100	53	100	0	47	
All Chinook	Number	0	9	9	38	4	42	51
	Percent	0	100	18	90	10	82	
Coho Fishery								
August	Number	0	0	0	44	6	50	50
	Percent	0	0	0	88	12	100	
All Sample Periods								
1998	Number	0	9	9	82	10	92	101
	Percent	0	100	9	89	11	91	

Table 11.-Species targeted by anglers interviewed during 1998 at the Holitna River.

Date		Resident			Non-Resident			Total
		Local	Non-Local	All	USA	Foreign	All	
<u>June</u>	Chinook							
	Number	0	0	0	23	3	26	26
	Percent							93
	Pike							
	Number	0	0	0	2	0	2	2
	Percent							7
	Sheefish							
	Number	0	0	0	0	0	0	0
	Percent							0
	Total	0	0	0	25	3	28	28
<u>July</u>	Chinook							
	Number	0	3	3	7	0	7	10
	Percent							71
	Pike							
	Number	0	0	0	0	0	0	0
	Percent							0
	Sheefish							
	Number	0	4	4	0	0	0	4
	Percent							29
	Total	0	7	7	7	0	7	14
<u>August</u>	Coho							
	Number	0	1	1	32	5	37	38
	Percent							69
	Pike							
	Number	0	1	1	14	1	15	16
	Percent							29
	Sheefish							
	Number	0	1	1	0	0	0	1
	Percent							2
	Total	0	3	3	46	6	52	55

-continued-

Table 11.-Page 2 of 2.

Date	Resident			Non-Resident			Total
	Local	Non-Local	All	USA	Foreign	All	
<u>All Sample Periods</u>							
Chinook							
Number	0	3	3	30	3	33	36
Percent			30			38	37
Coho							
Number	0	1	1	32	5	37	38
Percent			10			43	39
Pike							
Number	0	1	1	16	1	17	18
Percent			10			20	19
Sheefish							
Number	0	5	5	0	0	0	5
Percent			50			0	5
Total	0	10	10	78	9	87	97

Table 12.-Geographic location of anglers interviewed within the Holitna River survey area during 1998.

Location (mile)	June		July		August		All 1998	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent
23-25	0	0	6	35	0	0	6	6
26-30	0	0	0	0	16	36	16	17
31-35	34	100	3	18	6	13	43	45
36-40	0	0	0	0	0	0	0	0
41-45	0	0	0	0	15	33	15	16
46-50	0	0	0	0	0	0	0	0
51-55	0	0	8	47	8	18	16	17
Total	34		17		45		96	

Table 13.-Number of fish sampled and reported catch by anglers from the Holitna River, 1998.

Fish Species	Number Sampled			Reported by Anglers		
	Test Fishery	Sport Fishery	Total	Released	Kept	Total
Chinook	1	19	20	40	23	63
Coho	97	19	116	148	36	184
Chum	77	-	77	8	-	8
Sockeye	23	-	23	-	-	-
Northern Pike	227	4	231	197	4	201
Sheefish	21	8	29	3	6	9
Arctic grayling	26	-	26	-	-	-
Dolly Varden	3	-	3	-	-	-
Humpback Whitefish	3	-	3	-	-	-
Burbot	1	-	1	-	-	-
Total	479	50	529	396	69	465

In addition to samples from the sport fisheries, test fishing was conducted with gill nets, hoop nets, seines and hook and line gear. Northern pike were captured throughout the 110 miles of river surveyed during all sample periods. Sheefish were captured near the river's mouth, at the Sheefish hole (mile 23) and near the mouth of Titnuk Creek (mile 50-55). Arctic grayling and Dolly Varden were not captured except in upriver areas (mile 61-110). The numbers of each species captured in test fishing efforts are also listed in Table 13. The catch by gear type and the CPUE for each gear type is listed in Appendix A.

Chinook Salmon

Most of the chinook salmon harvested by the sport fishery were 700 mm or larger, corresponding to the larger than 28 in portion of the bag limit (Table 14). About two thirds of the harvest was composed of age-1.3 fish (Table 15). Only a single chinook was captured in test fishing efforts. The chinook salmon sampled in the sport fishery were almost entirely males (18 of 20, Table 14).

Coho Salmon

Nineteen coho salmon were sampled from the sport fishery; these fish were generally larger than 600 mm (Table 16). An additional 95 coho were sampled in the test fishery. Age-2.1 fish dominated the samples (83-84%) of both males and females (Table 15). Age-1.1 and 3.1 fish comprised the remainder of the sampled age groups. Male coho salmon accounted for about 65% of the fish sampled.

Chum Salmon

Chum salmon were not sampled from the sport fishery. Anglers reported catching and releasing eight chum salmon. In test fishing efforts 77 were sampled. Length and sex information are listed in Table 17. No age information is available from these samples. Males were more abundant (52 of 77, 68%) than females in the samples.

Sockeye Salmon

No sockeye salmon were sampled from the sport fishery nor did anglers report catching this species. A limited number (23) were sampled from the test fishing efforts. Length and sex information is listed in Table 18. Age information is found in Table 15. In contrast to samples of chinook, coho and chum salmon, female sockeye were slightly more abundant (20 of 34, 59%) in our sample. Age groups 1.2, 1.3 and 2.3 were represented with 1.3 the most common age group for females and 2.3 for males.

Northern Pike

Although a substantial number of northern pike were reportedly caught by anglers (201), nearly all were released (Table 13). Harvested northern pike ranged between 25 and 28 in TL (600-675 mm FL, Table 19) and were in age groups 6, 7, or 9 (Table 20). An additional 227 northern pike were sampled in test fishing efforts. The fish in these samples ranged from 231 to 1,093 mm FL with most between 425 and 700 mm FL (18 - 30 in TL). Age groups up to age-19 were represented in the samples with most samples age-4 through age-8. Because only 12 pike were killed, sex information is limited; 10 females averaged 675 mm FL and 2 males averaged 653 mm FL.

Table 14.-Length distribution of chinook salmon sampled from the Holitna River, 1998.

Length Group (Upper Limit)	All Samples									
	Sport Fishery		Test Fishery		Females		Males		Both Sexes	
	n	P (SE)	n	P (SE)	n	P (SE)	n	P (SE)	n	P (SE)
550	0	0.000 (0.000)	0	0.000 (0.000)	0	0.000 (0.000)	0	0.000 (0.000)	0	0.000 (0.000)
575	0	0.000 (0.000)	0	0.000 (0.000)	0	0.000 (0.000)	0	0.000 (0.000)	0	0.000 (0.000)
600	1	0.053 (0.051)	0	0.000 (0.000)	0	0.000 (0.000)	1	0.056 (0.054)	1	0.05 (0.049)
625	1	0.053 (0.051)	0	0.000 (0.000)	0	0.000 (0.000)	1	0.056 (0.054)	1	0.05 (0.049)
650	2	0.105 (0.070)	0	0.000 (0.000)	0	0.000 (0.000)	2	0.111 (0.074)	2	0.10 (0.067)
675	0	0.000 (0.000)	0	0.000 (0.000)	0	0.000 (0.000)	0	0.000 (0.000)	0	0.000 (0.000)
700	1	0.053 (0.051)	0	0.000 (0.000)	0	0.000 (0.000)	0	0.000 (0.000)	1	0.05 (0.049)
725	1	0.053 (0.051)	0	0.000 (0.000)	0	0.000 (0.000)	1	0.056 (0.054)	1	0.05 (0.049)
750	1	0.053 (0.051)	1	1.000 (0.000)	0	0.000 (0.000)	2	0.111 (0.074)	2	0.10 (0.067)
775	3	0.158 (0.084)	0	0.000 (0.000)	0	0.000 (0.000)	3	0.167 (0.088)	3	0.15 (0.080)
800	5	0.263 (0.101)	0	0.000 (0.000)	0	0.000 (0.000)	5	0.278(0.110)	5	0.25 (0.097)
825	0	0.000 (0.000)	0	0.000 (0.000)	0	0.000 (0.000)	0	0.000 (0.000)	0	0.000 (0.000)
850	2	0.105 (0.070)	0	0.000 (0.000)	0	0.000 (0.000)	2	0.111 (0.074)	2	0.10 (0.067)
875	0	0.000 (0.000)	0	0.000 (0.000)	0	0.000 (0.000)	0	0.000 (0.000)	0	0.000 (0.000)
900	0	0.000 (0.000)	0	0.000 (0.000)	0	0.000 (0.000)	0	0.000 (0.000)	0	0.000 (0.000)
925	1	0.053 (0.051)	0	0.000 (0.000)	0	0.000 (0.000)	1	0.056 (0.054)	1	0.05 (0.049)
950	0	0.000 (0.000)	0	0.000 (0.000)	0	0.000 (0.000)	0	0.000 (0.000)	0	0.000 (0.000)
975	0	0.000 (0.000)	0	0.000 (0.000)	0	0.000 (0.000)	0	0.000 (0.000)	0	0.000 (0.000)
1000	1	0.053 (0.051)	0	0.000 (0.000)	1	0.500 (0.353)	0	0.000 (0.000)	1	0.05 (0.049)
Count	19		1		2		18		20	
Average (mm)	760		750		846		750		759	
Min (mm)	590		750		700		590		590	
Max (mm)	991		750		991		920		991	

Table 15.-Age distribution of salmon sampled from the Holitna River, 1998.

Chinook Salmon					All Samples					
Age	Sport Fishery		Test Fishery		Females		Males		Both Sexes	
Group	number	P (SE)	number	P (SE)	number	P (SE)	number	P (SE)	number	P (SE)
1.2	1	0.063 (0.061)	0	0.000 (0.000)	0	0.000 (0.000)	1	0.067 (0.064)	1	0.059 (0.057)
1.3	10	0.625 (0.121)	1	1.000 (0.000)	1	0.500 (0.350)	10	0.667 (0.12)	11	0.647 (0.12)
1.4	5	0.313 (0.116)	0	0.000 (0.000)	1	0.500(0.350)	4	0.267 (0.11)	5	0.294 (0.10)
Total	16		1		2		15		17	
mode	1.3		1.3		1.4		1.3		1.3	
min	1.2		1.3		1.3		1.2		1.2	
max	1.4		1.3		1.4		1.4		1.4	

Coho Salmon					All Samples					
Age	Sport Fishery		Test Fishery		Females		Males		Both Sexes	
Group	number	P (SE)	number	P (SE)	number	P (SE)	number	P (SE)	number	P (SE)
1.1	2	0.154 (0.10)	2	0.025 (0.013)	2	0.057 (0.039)	2	0.035 (0.024)	4	0.043 (0.021)
2.1	11	0.846 (0.10)	66	0.835 (0.042)	29	0.829 (0.064)	48	0.842 (0.048)	77	0.837 (0.039)
3.1	0	0.000 (0.000)	11	0.139 (0.039)	4	0.114 (0.054)	7	0.123 (0.043)	11	0.120 (0.034)
Total	13		79		35		57		92	
mode	2.1		2.1		2.1		2.1		2.1	
min	1.1		1.1		1.1		1.1		1.1	
max	2.1		3.1		3.1		3.1		3.1	

-continued-

Table 15.-Page 2 of 2.

Sockeye Salmon					All Samples					
Age	Sport Fishery		Test Fishery		Females		Males		Both Sexes	
Group	number	P (SE)	number	P (SE)	number	P (SE)	number	P (SE)	number	P (SE)
1.2	0		1	0.036 (0.035)	0	0.000 (0.000)	1	0.077 (0.074)	1	0.036 (0.035)
1.3	0		16	0.571 (0.094)	10	0.667 (0.120)	5	0.385 (0.130)	16	0.571 (0.094)
2.3	0		11	0.393 (0.092)	5	0.333 (0.120)	7	0.538 (0.140)	11	0.393 (0.092)
Total	0		28		15		13		28	
mode			2.1		1.3		2.3		1.3	
min			1.1		1.3		1.2		1.2	
max			2.3		2.3		2.3		2.3	
No age data for chum salmon										

Table 16.-Length distribution of coho salmon sampled from the Holitna River, 1998.

Length Group (Upper Limit)	Sport Fishery		Test Fishery		All Samples					
					Females		Males		Both Sexes	
	n	P (SE)	n	P (SE)	n	P (SE)	n	P (SE)	n	p
350	0	0.000 (0.000)	0	0.000 (0.000)	0	0.000 (0.000)	0	0.000 (0.000)	0	0.000 (0.000)
375	0	0.000 (0.000)	0	0.000 (0.000)	0	0.000 (0.000)	0	0.000 (0.000)	0	0.000 (0.000)
400	0	0.000 (0.000)	1	0.011 (0.010)	0	0.000 (0.000)	1	0.014 (0.014)	1	0.009 (0.009)
425	0	0.000 (0.000)	0	0.000 (0.000)	0	0.000 (0.000)	0	0.000 (0.000)	0	0.000 (0.000)
450	0	0.000 (0.000)	0	0.000 (0.000)	0	0.000 (0.000)	0	0.000 (0.000)	0	0.000 (0.000)
475	0	0.000 (0.000)	2	0.021 (0.015)	0	0.000 (0.000)	2	0.027 (0.019)	2	0.018 (0.012)
500	0	0.000 (0.000)	3	0.032 (0.018)	0	0.000 (0.000)	2	0.027 (0.019)	3	0.026 (0.015)
525	2	0.105 (0.070)	7	0.074 (0.027)	5	0.125 (0.052)	3	0.041 (0.023)	9	0.079 (0.025)
550	1	0.053 (0.051)	5	0.053 (0.023)	1	0.025 (0.025)	5	0.068 (0.030)	6	0.053 (0.021)
575	2	0.105 (0.070)	13	0.137 (0.035)	5	0.125 (0.052)	10	0.137 (0.040)	15	0.132 (0.032)
600	5	0.263 (0.101)	37	0.389 (0.050)	20	0.500 (0.079)	22	0.301 (0.054)	42	0.368 (0.045)
625	7	0.368 (0.111)	18	0.189 (0.040)	5	0.125 (0.052)	20	0.274 (0.052)	25	0.219 (0.039)
650	2	0.105 (0.070)	6	0.063 (0.025)	2	0.050 (0.034)	6	0.082 (0.032)	8	0.070 (0.024)
675	0	0.000 (0.000)	2	0.021 (0.015)	1	0.025 (0.025)	0	0.000 (0.000)	2	0.018 (0.012)
700	0	0.000 (0.000)	1	0.011 (0.010)	1	0.025 (0.025)	0	0.000 (0.000)	1	0.009 (0.009)
725	0	0.000 (0.000)	0	0.000 (0.000)	0	0.000 (0.000)	0	0.000 (0.000)	0	0.000 (0.000)
750	0	0.000 (0.000)	0	0.000 (0.000)	0	0.000 (0.000)	0	0.000 (0.000)	0	0.000 (0.000)
Count	19		95		40		73		114	
Average (mm)	591		580		583		584		582	
Min (mm)	505		378		505		378		378	
Max (mm)	650		690		666		690		690	

Table 17.-Length distribution of chum salmon sampled from the Holitna River, 1998.

Length Group (Upper Limit)	All Samples									
	Sport Fishery		Test Fishery		Females		Males		Both Sexes	
	n	P (SE)	n	P (SE)	n	P (SE)	n	P (SE)	n	P (SE)
350	0		0	0.000 (0.000)	0	0.000 (0.000)	0	0.000 (0.000)	0	0.000 (0.000)
375	0		0	0.000 (0.000)	0	0.000 (0.000)	0	0.000 (0.000)	0	0.000 (0.000)
400	0		0	0.000 (0.000)	0	0.000 (0.000)	0	0.000 (0.000)	0	0.000 (0.000)
425	0		0	0.000 (0.000)	0	0.000 (0.000)	0	0.000 (0.000)	0	0.000 (0.000)
450	0		0	0.000 (0.000)	0	0.000 (0.000)	0	0.000 (0.000)	0	0.000 (0.000)
475	0		0	0.000 (0.000)	0	0.000 (0.000)	0	0.000 (0.000)	0	0.000 (0.000)
500	0		0	0.000 (0.000)	0	0.000 (0.000)	0	0.000 (0.000)	0	0.000 (0.000)
525	0		4	0.118 (0.025)	4	0.200 (0.073)	0	0.000 (0.000)	4	0.118 (0.025)
550	0		12	0.353 (0.041)	7	0.350 (0.090)	5	0.357 (0.041)	12	0.353 (0.041)
575	0		13	0.382 (0.042)	3	0.150 (0.065)	10	0.714 (0.055)	13	0.382 (0.042)
600	0		23	0.676 (0.052)	4	0.200 (0.073)	18	1.286 (0.066)	23	0.676 (0.052)
625	0		14	0.412 (0.043)	4	0.200 (0.073)	10	0.714 (0.055)	14	0.412 (0.043)
650	0		6	0.176 (0.030)	3	0.150 (0.065)	3	0.214 (0.032)	6	0.176 (0.030)
675	0		2	0.059 (0.018)	0	0.000 (0.000)	2	0.0143 (0.027)	2	0.059 (0.018)
700	0		4	0.118 (0.025)	0	0.000 (0.000)	4	0.286 (0.037)	4	0.118 (0.025)
725	0		0	0.000 (0.000)	0	0.000 (0.000)	0	0.000 (0.000)	0	0.000 (0.000)
750	0		0	0.000 (0.000)	0	0.000 (0.000)	0	0.000 (0.000)	0	0.000 (0.000)
Count	0		78		25		52		78	
Average (mm)			588		570		597		588	
Min (mm)			515		515		530		515	
Max (mm)			700		640		700		700	

Table 18.-Length distribution of sockeye salmon sampled from the Holitna River, 1998.

Length Group (Upper Limit)	All Samples									
	Sport Fishery		Test Fishery		Females		Males		Both Sexes	
	n	P (SE)	n	P (SE)	n	P (SE)	n	P (SE)	n	P (SE)
350	0	0.000 (0.000)	0	0.000 (0.000)	0	0.000 (0.000)	0	0.000 (0.000)	0	0.000 (0.000)
375	0	0.000 (0.000)	0	0.000 (0.000)	0	0.000 (0.000)	0	0.000 (0.000)	0	0.000 (0.000)
400	0	0.000 (0.000)	0	0.000 (0.000)	0	0.000 (0.000)	0	0.000 (0.000)	0	0.000 (0.000)
425	0	0.000 (0.000)	0	0.000 (0.000)	0	0.000 (0.000)	0	0.000 (0.000)	0	0.000 (0.000)
450	0	0.000 (0.000)	1	0.029 (0.029)	1	0.050 (0.049)	0	0.000 (0.000)	1	0.029 (0.029)
475	0	0.000 (0.000)	0	0.000 (0.000)	0	0.000 (0.000)	0	0.000 (0.000)	0	0.000 (0.000)
500	0	0.000 (0.000)	2	0.059 (0.040)	2	0.100 (0.067)	0	0.000 (0.000)	2	0.059 (0.040)
525	0	0.000 (0.000)	4	0.118 (0.055)	4	0.200 (0.089)	0	0.000 (0.000)	4	0.118 (0.055)
550	0	0.000 (0.000)	9	0.265 (0.076)	6	0.300 (0.102)	3	0.214 (0.110)	9	0.265 (0.076)
575	0	0.000 (0.000)	9	0.265 (0.076)	5	0.250 (0.097)	4	0.286 (0.121)	9	0.265 (0.076)
600	0	0.000 (0.000)	3	0.088 (0.049)	1	0.050 (0.049)	2	0.143 (0.094)	3	0.088 (0.049)
625	0	0.000 (0.000)	4	0.118 (0.055)	1	0.050 (0.049)	3	0.214 (0.110)	4	0.118 (0.055)
650	0	0.000 (0.000)	2	0.059 (0.040)	0	0.000 (0.000)	2	0.143 (0.094)	2	0.059 (0.040)
675	0	0.000 (0.000)	0	0.000 (0.000)	0	0.000 (0.000)	0	0.000 (0.000)	0	0.000 (0.000)
700	0	0.000 (0.000)	0	0.000 (0.000)	0	0.000 (0.000)	0	0.000 (0.000)	0	0.000 (0.000)
725	0	0.000 (0.000)	0	0.000 (0.000)	0	0.000 (0.000)	0	0.000 (0.000)	0	0.000 (0.000)
750	0	0.000 (0.000)	0	0.000 (0.000)	0	0.000 (0.000)	0	0.000 (0.000)	0	0.000 (0.000)
Count	0		34		20		14		34	
Average			557		537		586		557	
Min			428		428		544		428	
Max			650		605		650		650	

Table 19.-Length distribution of northern pike sampled from the Holitna River, 1998.

Length Group	Sport Fishery		Test Fishery		All Samples	
	n	P (SE)	n	P (SE)	n	P (SE)
300	0	0.000 (0.000)	4	0.018 (0.009)	4	0.017 (0.009)
325	0	0.000 (0.000)	2	0.009 (0.006)	2	0.009 (0.006)
350	0	0.000 (0.000)	4	0.018 (0.009)	4	0.017 (0.009)
375	0	0.000 (0.000)	2	0.009 (0.006)	2	0.009 (0.006)
400	0	0.000 (0.000)	4	0.018 (0.009)	4	0.017 (0.009)
425	0	0.000 (0.000)	5	0.022 (0.010)	5	0.022 (0.010)
450	0	0.000 (0.000)	11	0.048 (0.014)	11	0.048 (0.014)
475	0	0.000 (0.000)	11	0.048 (0.014)	11	0.048 (0.014)
500	0	0.000 (0.000)	15	0.066 (0.016)	15	0.065 (0.016)
525	0	0.000 (0.000)	12	0.053 (0.015)	12	0.052 (0.015)
550	0	0.000 (0.000)	21	0.093 (0.019)	21	0.091 (0.019)
575	0	0.000 (0.000)	27	0.119 (0.021)	27	0.117 (0.021)
600	0	0.000 (0.000)	29	0.128 (0.022)	29	0.126 (0.022)
625	2	0.500 (0.250)	22	0.097 (0.020)	24	0.104 (0.020)
650	0	0.000 (0.000)	8	0.035 (0.012)	8	0.035 (0.012)
675	2	0.500 (0.250)	12	0.053 (0.015)	14	0.061 (0.016)
700	0	0.000 (0.000)	7	0.031 (0.011)	7	0.030 (0.011)
725	0	0.000 (0.000)	4	0.018 (0.009)	4	0.017 (0.009)
750	0	0.000 (0.000)	7	0.031 (0.011)	7	0.030 (0.011)
775	0	0.000 (0.000)	3	0.013 (0.008)	3	0.013 (0.007)
800	0	0.000 (0.000)	3	0.013 (0.008)	3	0.013 (0.007)
825	0	0.000 (0.000)	4	0.018 (0.009)	4	0.017 (0.009)
850	0	0.000 (0.000)	3	0.013 (0.008)	3	0.013 (0.007)
875	0	0.000 (0.000)	1	0.004 (0.004)	1	0.004 (0.004)
900	0	0.000 (0.000)	1	0.004 (0.004)	1	0.004 (0.004)
925	0	0.000 (0.000)	2	0.009 (0.006)	2	0.009 (0.006)
950	0	0.000 (0.000)	0	0.000 (0.000)	0	0.000 (0.000)
975	0	0.000 (0.000)	1	0.004 (0.004)	1	0.004 (0.004)
1000	0	0.000 (0.000)	1	0.004 (0.004)	1	0.004 (0.004)
1025	0	0.000 (0.000)	0	0.000 (0.000)	0	0.000 (0.000)
1050	0	0.000 (0.000)	0	0.000 (0.000)	0	0.000 (0.000)
1075	0	0.000 (0.000)	0	0.000 (0.000)	0	0.000 (0.000)
1100	0	0.000 (0.000)	1	0.004 (0.004)	1	0.004 (0.004)
Count	4		227		231	
Average (mm)	644		577		578	
Min (mm)	624		284		284	
Max (mm)	670		1,093		1,093	

10 females (average 675 mm), 2 males (average 653 mm)

Table 20.-Age distribution of northern pike sampled from the Holitna River, 1998.

Age Group	Sport Fishery		Test Fishery		All Samples	
	n	P (SE)	n	P (SE)	n	P (SE)
1	0	0.000 (0.000)	14	0.061 (0.016)	14	0.060 (0.016)
2	0	0.000 (0.000)	5	0.022 (0.010)	5	0.022 (0.010)
3	0	0.000 (0.000)	17	0.075 (0.017)	17	0.073 (0.017)
4	0	0.000 (0.000)	26	0.114 (0.021)	26	0.112 (0.021)
5	0	0.000 (0.000)	38	0.167 (0.025)	38	0.164 (0.024)
6	2	0.500 (0.250)	43	0.189 (0.026)	45	0.194 (0.026)
7	1	0.250 (0.0217)	36	0.158 (0.024)	37	0.159 (0.024)
8	0	0.000 (0.000)	19	0.083 (0.018)	19	0.082 (0.018)
9	1	0.250 (0.217)	10	0.044 (0.014)	11	0.047 (0.014)
10	0	0.000 (0.000)	70	0.031 (0.031)	7	0.030 (0.011)
11	0	0.000 (0.000)	2	0.009 (0.006)	2	0.009 (0.006)
12	0	0.000 (0.000)	5	0.022 (0.010)	5	0.022 (0.010)
13	0	0.000 (0.000)	1	0.004 (0.004)	1	0.004 (0.004)
14	0	0.000 (0.000)	1	0.004 (0.004)	1	0.004 (0.004)
15	0	0.000 (0.000)	3	0.013 (0.008)	3	0.013 (0.007)
16	0	0.000 (0.000)	0	0.000 (0.000)	0	0.000 (0.000)
17	0	0.000 (0.000)	0	0.000 (0.000)	0	0.000 (0.000)
18	0	0.000 (0.000)	0	0.000 (0.000)	0	0.000 (0.000)
19	0	0.000 (0.000)	1	0.004 (0.004)	1	0.004 (0.004)
20	0	0.000 (0.000)	0	0.000 (0.000)	0	0.000 (0.000)
Total	4		228		232	
Average (mm)	7		6		6	
Min (mm)	6		2		2	
Max (mm)	9		19		19	

Sheefish

Very few sheefish were caught in the Holitna River study area. Only nine sheefish were reportedly caught by anglers during the survey periods of which 6 were harvested. Length, and sex data are found in Table 21; age information is listed in Table 22. An additional 21 sheefish were caught in test fishing gear. The fish in the sample ranged from 524 to 805 mm FL and in age from 6 to 8 years. These larger fish in the sample were not killed and reliable ages were not obtained. Otoliths for investigation of anadromy were archived for subsequent analysis.

Arctic Grayling

Arctic grayling were not targeted by anglers in the study area and no incidental catch was reported during angler interviews. Test fishing efforts obtained a sample of 26 Arctic grayling ranging from 220 to 410 mm FL. Age groups encountered ranged from age-3 to age-10. Complete length and age data from this sample are given in Table 23 and Table 24.

Dolly Varden

Dolly Varden were not targeted by anglers in the study area and no incidental catch was reported during angler interviews. Only three Dolly Varden were captured in the test fishery. The lengths were 430, 445 and 452 mm FL. No sex or age information were obtained because these fish were released alive.

DISCUSSION

The chinook salmon fishery began in late June and continued through mid-July. The number of sites that provide good fishing for chinook salmon along the Holitna River are few. As a result, these sites are subject to crowding. The most popular location is at the confluence of the Hoholitna and the Holitna rivers. Other sites are farther upstream (Tinuk Creek, Taylor Creek, etc.) and are accessible primarily via float-equipped aircraft.

Anglers targeting sheefish were present beginning the last week of June. Sheefish concentrate in pools in the lower river to feed on out-migrating salmon. The most popular site (“Sheefish Hole”) is located at approximately mile 23.

The relative popularity of sheefish in the sport fishery was much less than anticipated. Only 10% of anglers said that they were targeting sheefish and all of these were Alaskan residents. Prior to the survey, we believed that this fishery would likely be finished by mid-July. However, sheefish were captured with hook and line gear by project personnel during the last week of August from the “Sheefish Hole” - this suggests that additional angling opportunity for sheefish exists.

Anglers targeting coho salmon are present from mid-August until the end of the season. Much of the sport fishing effort during this period in 1998 was a secondary activity for hunting trips to the area for caribou and moose. However, one local operator provided trips for visitors targeting coho salmon.

Overall the salmon runs in the Kuskokwim River in 1998 were among the poorest on record. Various test fisheries and escapement projects indicated low to adequate returns of chinook and sockeye salmon but poor runs of chum and below average coho run strength (see Appendix B). Due to unusually high water levels throughout the Kuskokwim River drainage, most escapement projects were unable to operate for significant portions of the chinook, sockeye and chum runs.

Table 21.-Length distribution of sheefish sampled from the Holitna River, 1998.

Length Group	Sport Fishery		Test Fishery		All Samples	
	n	P (SE)	n	P (SE)	n	P (SE)
300	0	0.000 (0.000)	0	0.000 (0.000)	0	0.000 (0.000)
325	0	0.000 (0.000)	0	0.000 (0.000)	0	0.000 (0.000)
350	0	0.000 (0.000)	0	0.000 (0.000)	0	0.000 (0.000)
375	0	0.000 (0.000)	0	0.000 (0.000)	0	0.000 (0.000)
400	0	0.000 (0.000)	0	0.000 (0.000)	0	0.000 (0.000)
425	0	0.000 (0.000)	0	0.000 (0.000)	0	0.000 (0.000)
450	0	0.000 (0.000)	0	0.000 (0.000)	0	0.000 (0.000)
475	0	0.000 (0.000)	0	0.000 (0.000)	0	0.000 (0.000)
500	0	0.000 (0.000)	0	0.000 (0.000)	0	0.000 (0.000)
525	0	0.000 (0.000)	1	0.004 (0.057)	1	0.004 (0.039)
550	0	0.000 (0.000)	0	0.000 (0.000)	0	0.000 (0.000)
575	0	0.000 (0.000)	1	0.004 (0.057)	1	0.004 (0.039)
600	1	0.250 (0.117)	0	0.000 (0.000)	1	0.004 (0.039)
625	3	0.750 (0.171)	2	0.009 (0.078)	5	0.022 (0.080)
650	2	0.500 (0.153)	1	0.004 (0.057)	3	0.013 (0.065)
675	0	0.000 (0.000)	2	0.009 (0.078)	2	0.009 (0.054)
700	1	0.250 (0.117)	3	0.013 (0.092)	4	0.017 (0.073)
725	1	0.250 (0.117)	5	0.022 (0.111)	6	0.026 (0.085)
750	0	0.000 (0.000)	1	0.004 (0.057)	1	0.004 (0.039)
775	0	0.000 (0.000)	0	0.000 (0.000)	0	0.000 (0.000)
800	0	0.000 (0.000)	0	0.000 (0.000)	0	0.000 (0.000)
825	0	0.000 (0.000)	1	0.004 (0.057)	1	0.004 (0.039)
850	0	0.000 (0.000)	0	0.000 (0.000)	0	0.000 (0.000)
Count	8		17		25	
Average (mm)	642		672		663	
Min (mm)	594		524		524	
Max (mm)	724		805		805	

Table 22.-Age distribution of sheefish sampled from the Holitna River.

Age Group	Sport Fishery		Test Fishery		All Samples	
	n	P (SE)	n	P (SE)	n	P (SE)
1	0	0.000 (0.000)	0	0.000 (0.000)	0	0.000 (0.000)
2	0	0.000 (0.000)	0	0.000 (0.000)	0	0.000 (0.000)
3	0	0.000 (0.000)	0	0.000 (0.000)	0	0.000 (0.000)
4	0	0.000 (0.000)	0	0.000 (0.000)	0	0.000 (0.000)
5	0	0.000 (0.000)	1	0.071 (0.069)	1	0.000 (0.051)
6	3	0.600 (0.219)	6	0.429 (0.132)	9	0.053 (0.115)
7	1	0.200 (0.179)	6	0.429 (0.132)	7	0.474 (0.111)
8	1	0.200 (0.179)	1	0.071 (0.069)	2	0.368 (0.070)
9	0	0.000 (0.000)	0	0.000 (0.000)	0	0.105 (0.000)
10	0	0.000 (0.000)	0	0.000 (0.000)	0	0.000 (0.000)
11	0	0.000 (0.000)	0	0.000 (0.000)	0	0.000 (0.000)
12	0	0.000 (0.000)	0	0.000 (0.000)	0	0.000 (0.000)
13	0	0.000 (0.000)	0	0.000 (0.000)	0	0.000 (0.000)
14	0	0.000 (0.000)	0	0.000 (0.000)	0	0.000 (0.000)
15	0	0.000 (0.000)	0	0.000 (0.000)	0	0.000 (0.000)
16	0	0.000 (0.000)	0	0.000 (0.000)	0	0.000 (0.000)
17	0	0.000 (0.000)	0	0.000 (0.000)	0	0.000 (0.000)
18	0	0.000 (0.000)	0	0.000 (0.000)	0	0.000 (0.000)
19	0	0.000 (0.000)	0	0.000 (0.000)	0	0.000 (0.000)
20	0	0.000 (0.000)	0	0.000 (0.000)	0	0.000 (0.000)
Total	5		14		19	
Average (mm)	7		6		6	
Min (mm)	6		5		1	
Max (mm)	8		8		8	

Table 23.-Length distribution of Arctic grayling sampled from the Holitna River, 1998.

Length Group	Sport Fishery		Test Fishery		All Samples	
	n	P (SE)	n	p	n	P (SE)
200	0	0.000 (0.000)	0	0.000 (0.000)	0	0.000 (0.000)
225	0	0.000 (0.000)	1	0.038 (0.038)	1	0.038 (0.038)
250	0	0.000 (0.000)	0	0.000 (0.000)	0	0.000 (0.000)
275	0	0.000 (0.000)	0	0.000 (0.000)	0	0.000 (0.000)
300	0	0.000 (0.000)	0	0.000 (0.000)	0	0.000 (0.000)
325	0	0.000 (0.000)	6	0.231 (0.083)	6	0.231 (0.083)
350	0	0.000 (0.000)	9	0.346 (0.093)	9	0.346 (0.093)
375	0	0.000 (0.000)	4	0.154 (0.071)	4	0.154 (0.071)
400	0	0.000 (0.000)	5	0.192 (0.077)	5	0.192 (0.077)
425	0	0.000 (0.000)	1	0.038 (0.038)	1	0.038 (0.038)
450	0	0.000 (0.000)	0	0.000 (0.000)	0	0.000 (0.000)
Count	0		26		26	
Average (mm)			345		345	
Min (mm)			220		220	
Max (mm)			410		410	

Table 24.-Age distribution of Arctic grayling sampled from the Holitna River.

Age Group	Sport Fishery		Test Fishery		All Samples	
	n	P (SE)	n	P (SE)	n	P (SE)
1	0	0.000 (0.000)	0	0.000 (0.000)	0	0.000 (0.000)
2	0	0.000 (0.000)	0	0.000 (0.000)	0	0.000 (0.000)
3	0	0.000 (0.000)	1	0.000 (0.038)	1	0.038 (0.038)
4	0	0.000 (0.000)	0	0.000 (0.000)	0	0.000 (0.000)
5	0	0.000 (0.000)	3	0.115 (0.063)	3	0.115 (0.063)
6	0	0.000 (0.000)	9	0.346 (0.093)	9	0.346 (0.093)
7	0	0.000 (0.000)	6	0.231 (0.083)	6	0.231 (0.083)
8	0	0.000 (0.000)	2	0.077 (0.052)	2	0.077 (0.052)
9	0	0.000 (0.000)	1	0.038 (0.038)	1	0.038 (0.038)
10	0	0.000 (0.000)	2	0.077 (0.052)	2	0.077 (0.052)
11	0	0.000 (0.000)	0	0.000 (0.000)	0	0.000 (0.000)
12	0	0.000 (0.000)	0	0.000 (0.000)	0	0.000 (0.000)
13	0	0.000 (0.000)	0	0.000 (0.000)	0	0.000 (0.000)
14	0	0.000 (0.000)	0	0.000 (0.000)	0	0.000 (0.000)
15	0	0.000 (0.000)	0	0.000 (0.000)	0	0.000 (0.000)
16	0	0.000 (0.000)	0	0.000 (0.000)	0	0.000 (0.000)
17	0	0.000 (0.000)	0	0.000 (0.000)	0	0.000 (0.000)
18	0	0.000 (0.000)	0	0.000 (0.000)	0	0.000 (0.000)
19	0	0.000 (0.000)	0	0.000 (0.000)	0	0.000 (0.000)
20	0	0.000 (0.000)	0	0.000 (0.000)	0	0.000 (0.000)
Total	0		26		26	
Average (mm)			6		6	
Min (mm)			3		3	
Max (mm)			10		10	

The SWHS indicates that a substantial portion of anglers catch northern pike, Arctic grayling and to a lesser degree Dolly Varden. Northern pike were targeted by a portion (19% overall, 29% in August) of the anglers contacted in 1998, and many anglers reported catching northern pike as a secondary target during trips for sheefish, chinook or coho salmon. Arctic grayling and Dolly Varden were largely absent from test fishing catches in the portion of the Holitna River included in the angler survey. No anglers contacted during the survey reported catching either Arctic grayling or Dolly Varden. Anglers fishing upstream of the survey area likely account for the catch and harvest reported in the SWHS.

Low numbers of fish sampled from the sport fisheries reflects the low level of fishing that occurred in 1998. The number of anglers encountered was low: 51 between 25 June and 16 July, 50 between 22-28 August. Although estimates of harvest and catch provided by the SWHS (Table 1) for resident and anadromous species indicate increases in the level of use of these species in the Holitna River, the level of use remains modest. Except for a brief period centered around the 4th of July, when up to 15 anglers in five boats were observed anchored near the mouth of the Hohlitna River, fishing pressure was light in 1998. In an area generally without anglers, this concentration of fishing pressure is striking.

The numbers of anglers observed during 1998 may not have been representative of recent trends. Two factors likely affected the level of angling effort. First, the flood conditions in early spring followed by heavy rains in July resulted in poor conditions for angling. Complete trees were observed floating down the Holitna River in the second week of July. The second factor is the lower numbers of clients that were booked by the only full time fishing guide with a lodge located up river. Many of his clients canceled following a fire which destroyed the lodge during the winter 1997-98. Although this operator was fully operational by summer 1998, many of his clients assumed he would not be.

Angling also occurred (primarily by local people – Sleetmute, Red devil, Crooked Creek) for coho, sheefish and northern pike in the lower river and for chinook salmon in Vreeland Creek (across from Sleetmute). These areas were not included in the survey because of the logistic difficulties of covering an additional 40 mi of river each day. We obtained casual observations of these fishing activities during supply trips to Sleetmute and from conversations with local anglers.

There also appears to be a moderate amount of fishing by fly-in anglers in the upper part of the drainage. A minimum of three guiding businesses keep boats upstream for use by fly-in anglers. Anglers are also dropped off to float down the Kogruklu River. Anecdotal reports indicate that these visitors are primarily targeting chinook salmon.

The primary goal of this project was to assess the levels of guided and unguided angling activity; a secondary goal was to obtain baseline information on the fish stocks of the Holitna drainage. Although the level of angling effort is currently limited, it is clear that these fisheries are currently in a period of evolution from small, locally-based and remote to a higher-volume, higher-profile opportunity. I recommend that a similar investigation of the Holitna River be conducted during the summer of 2000. This study should concentrate on the chinook season, the last week of June through the week following the 4th of July. Anglers are most concentrated during this part of the fishery and the information could be accrued in cost effective manner.

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LITERATURE CITED

- ADF&G (Alaska Department of Fish and Game). 1998. 1998 Alaska sport fishing regulations summary. Alaska Department of Fish and Game, Juneau
- Babaluk, J. A., and J. D. Reist. 1996b. The use of strontium distribution in broad whitefish otoliths for determining life history and stock differences. An informal, preliminary report prepared for the Gwich'in Renewable Resource Board. Department of Fisheries and Oceans. Winnipeg, Manitoba.
- Babaluk, J. A., and seven other authors. 1997. Evidence for non-anadromous behavior of Arctic charr (*Salvelinus alpinus*) from Lake Hazen, Ellesmere Island, Northwest Territories, Canada, based on scanning proton microprobe analysis of otolith strontium distribution. *Arctic* 50(3): 224-233.
- Bernard, D. R., A. E. Bingham, and M. Alexandersdottir. 1998. The mechanics of conducting onsite creel surveys in Alaska. Alaska Department of Fish and Game, Special Publication 98-1, Anchorage.
- Efron, B., and R. J. Tibshirani. 1993. An introduction to the bootstrap. Chapman and Hall, New York.
- Howe, A. L., G. Fidler, and M. J. Mills. 1995. Harvest, catch, and participation in Alaska sport fisheries during 1994. Alaska Department of Fish and Game, Fishery Data Series No. 95-24, Anchorage.
- Howe, A. L., G. Fidler, A. E. Bingham, and M. J. Mills. 1996. Harvest, catch, and participation in Alaska sport fisheries during 1995. Alaska Department of Fish and Game, Fishery Data Series No. 96-32, Anchorage.
- Howe, A. L., G. Fidler, C. Olnes, A. E. Bingham, and M. J. Mills. 1997. Harvest, catch, and participation in Alaska sport fisheries during 1996. Alaska Department of Fish and Game, Fishery Data Series No. 97-29, Anchorage.
- Howe, A. L., G. Fidler, C. Olnes, A. E. Bingham, and M. J. Mills. 1998. Harvest, catch, and participation in Alaska sport fisheries during 1997. Alaska Department of Fish and Game, Fishery Data Series No. 98-25, Anchorage.
- Jearld, A., Jr. 1983. Age determination. Pages 301-324, in L. A. Nielsen, editors. Fisheries techniques. The American Fisheries Society, Bethesda, Maryland.
- Sokal, R. R., and F. J. Rohlf. 1981. Biometry, second edition. W. H. Freeman and Company, New York.

APPENDIX A

Appendix A1.-Test fishing results with various gear types from the Holitna River, 1998.

Effort			KS	CS	SS	RS	NP	SF	GR	DV	BB	BWF	LCI	HWF	RWF	LNS	ALL
<u>Gillnets</u>																	
June	32.0	Catch	1	7	0	5	11	2	9	1	0	0	0	0	1	14	51
		CPUE	0.031	0.219	0	0.156	0.343	0.062	0.281	0.031	0	0	0	0	0.031	0.437	1.592
July	73.9	Catch	0	57	0	21	42	4	12	0	0	1	4	5	0	2	148
		CPUE	0	0.771	0	0.284	0.568	0.054	0.162	0	0	0.014	0.054	0.068	0	0.027	2.002
August	33.1	Catch	0	0	0	0	30	1	0	0	0	0	0	0	0	0	31
		CPUE	0	0	0	0	0.907	0.03	0	0	0	0	0	0	0	0	0.937
Total	139.0	Catch	1	64	0	26	83	7	21	1	0	1	4	5	1	16	230
		CPUE	0.007	0.46	0	0.187	0.597	0.05	0.151	0.007	0	0.007	0.029	0.036	0.007	0.115	1.654
<u>Beach Seine</u>	(number of sets)																
June	0	Catch	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		CPUE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
July	8	Catch	0	11	0	0	0	0	39	0	0	0	0	0	41	42	133
		CPUE	0	0	0	0	0	0	4.875	0	0	0	0	0	5.125	5.25	15.25
August	6	Catch	0	0	6	0	0	0	0	0	0	0	0	0	0	0	6
		CPUE	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1
Total	14	Catch	0	11	6	0	0	0	39	0	0	0	0	0	41	42	139
		CPUE	0	0.786	0.429	0	0	0	2.786	0	0	0	0	0	2.929	3	9.929
<u>Hoop Nets</u>	(12 hour sets)																
June	0	Catch	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		CPUE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
July	51	Catch	0	0	0	0	13	0	1	0	1	0	0	0	0	0	15
		CPUE	0	0	0	0	0.3	0	0.02	0	0.02	0	0	0	0	0	0.3
August	14	Catch	0	0	0	0	7	0	0	0	0	0	0	0	0	0	7
		CPUE	0	0	0	0	0.5	0	0	0	0	0	0	0	0	0	0.5
Total	65	Catch	0	0	0	0	20	0	1	0	1	0	0	0	0	0	22
		CPUE	0	0	0	0	0.3	0	0.02	0	0.02	0	0	0	0	0	0.3

-continued-

Appendix A1.-Page 2 of 2.

Effort			KS	CS	SS	RS	NP	SF	GR	DV	BB	BWF	LCI	HWF	RWF	LNS	ALL
<u>Hook & Line</u>																	
June	20.6	Catch	0	1	0	0	27	2	7	1	0	0	0	0	0	0	38
		CPUE	0	0.05	0	0	1.3	0.1	0.3	0.05	0	0	0	0	0	0	1.8
July	26.0	Catch	0	7	0	1	57	6	3	0	0	0	0	0	0	0	74
		CPUE	0	0.3	0	0.04	2.2	0.2	0.1	0	0	0	0	0	0	0	2.9
August	21.8	Catch	0	0	57	0	39	6	0	1	0	0	0	0	0	0	103
		CPUE	0	0	2.6	0	1.8	0.3	0	0.05	0	0	0	0	0	0	4.7
Total	68.4	Catch	0	8	57	1	123	14	10	2	0	0	0	0	0	0	215
		CPUE	0	0.1	0.8	0.0	1.8	0.2	0.1	0.0	0	0	0	0	0	0	3.1

Appendix A2.-Presence/absence of resident species captured by mile in June, July and August in the Holitna River, 1998.

Date/ Specie	0-10	11-20	21-30	31-40	41-50	51-60	61-110
June							
Northern Pike	X	X	X	X	X	X	X
Sheefish	X		X			X	
Arctic grayling							X
Dolly Varden							X
July							
Northern Pike	X	X	X	X	X	X	X
Sheefish	X		X				
Arctic grayling							X
Dolly Varden							X
August							
Northern Pike	X	X	X	X	X	X	
Sheefish	X		X		X		
Arctic grayling							
Dolly Varden							

APPENDIX B

Appendix B.-Escapement data from the Kogrukluk River weir and from aerial surveys of the Holitna River.

Year	Kogrukluk River Weir				Holitna River (Aerial Survey)
	King	Sockeye	Coho	Chum	Sockeye
1976	5,579	2,326		8,117	2,247
1977					
1978	13,667	1,670		48,125	
1979	11,338	2,638			
1980					
1981	16,655	18,066	11,455	57,365	
1982			37,796		480
1983			8,538		
1984	4,928	4,133	27,595	41,484	101
1985	4,619	4,359	16,441	15,005	
1986				14,693	575
1987			22,821		
1988	8,505	4,397	13,512		
1989					
1990	10,218	8,406			
1991		16,455		26,765	
1992	6,755	7,540		24,188	
1993	12,332	29,358		34,105	860
1994			34,695	31,899	2,675
1995	20,630	10,996			
1996	14,199	15,385	50,555	31,265	1,780
1997	13,286	13,078	12,237	48,495	
1998			24,344	7,958	2,300
Mean	10,978	9,915	23,635	29,959	1,377
Current Escapement Goal	10,000	2,000	25,000	30,000	1,000